

UPDATE

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Memory breakthrough drives miniaturization

You can use it like RAM and carry it around like a disk. Flash EPROM technology is poised to change the way portables are made.

Last year—a year in which assumptions about the world seemed to fall with bewildering regularity—a truism about computers suddenly became irrelevant. Intel Corp. in Santa Clara, Calif., unveiled a new type of memory chip, the flash EPROM, which combines the flexibility of RAM with the permanence of disks. The distinction between RAM and disk started crumbling like the Berlin Wall.

Now the implications of flash EPROMs for portable computing—particularly notebooks and handhelds—are becoming clearer. If supporters of the technology are correct, flash EPROMs could eventually replace bulky, power-sapping disk drives in computers and serve as a universal storage medium for nearly every electronic device that uses memory.

Based on older EPROM (erasable programmable read-only memory) technology, flash EPROMs do not need a backup power supply to retain data. Like regular EPROMs and dynamic RAMs (DRAMs), they can be packaged in plastic cases and plugged into computer motherboards. And like static RAMs (SRAMs), they can be integrated on credit-card-size mem-

ory cards, providing a removable storage medium for software. Intel guarantees 10 years of data life.

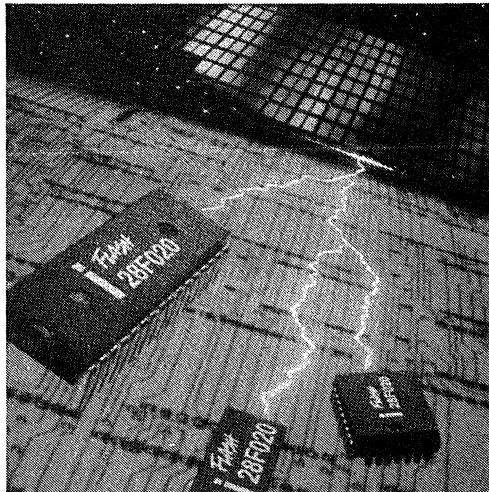
Flash EPROMs are likely to rearrange the mix of chip- and disk-based storage in all computers, especially the smallest portables. When used on removable cards, they can replace floppy drives, eventually for one-quarter the cost of currently available SRAM cards, according to Intel. At this writing, however, computer makers were waiting for lower prices before making the jump from SRAMs to the new chips.

Flash EPROMs could also be used

to store programs (such as Tandy's Deskmate interface or MS-DOS) which now take several seconds to load from hard disk to RAM while sucking up precious electricity. Programs stored in flash EPROMs load nearly instantaneously. One company, Cardinal Technologies Inc. (Lancaster, Pa.) plans to offer an expansion board containing Digital Research's DR DOS in regular ROM paired with 2MB of flash EPROM for storing applications.

Engineers also envision flash EPROMs bringing major changes to the embedded computers and controllers that are becoming mainstays of modern life. Computerized engines could be reprogrammed to reflect evolving fuel mixtures as a car ages (currently, such programmable memory is dependent on battery power). Digital electronic cameras will use flash EPROMs instead of digital tape or film to store photographs with sharpness comparable to that of 35-millimeter cameras.

Although London-based Psion PLC is first out of the gate with two flash-based notebook computers, the MC200 and MC400 (available this summer) you can expect to see other innovative



Intel's flash EPROM chips can store data without a constant supply of electricity.

machines using the new technology by early next year, according to Intel.

Hardware and software vendors are already using flash EPROMs to store vital code normally residing on ROM chips that can't be conveniently reprogrammed. When encoded in flash EPROMs, the computer's ROM BIOS, which manages hardware's interaction with software, can be updated via modem or floppy disk. (Phoenix Technologies Ltd., the largest BIOS maker, began offering flash EPROM versions of its products last spring.) BIOS upgradability will let you take advantage of new power-management breakthroughs and laptop peripherals without buying a new machine.

Flash EPROMs have one disadvantage that slightly limits their use: writing data to them takes nearly as much time as writing to a floppy. For this reason, they aren't as efficient as regular RAM at running applications like word processors and databases, which involve opening and closing files regularly. Flash EPROM proponents admit that computers based on the technology will sometimes use traditional DRAM storage for data manipulation, with flash EPROM cards taking the place of floppy and hard disks.

All the major laptop vendors are considering flash EPROMs, according to Kurt Robinson, Intel's product line architect for flash EPROMs. "Just about everybody is updating the BIOS portion of their machines from

ROM to flash," Robinson says. In addition, Microsoft has thrown its support behind the technology by releasing file-management software that lets MS-DOS treat flash EPROMs like disk drives.

Intel expects steady increases in flash EPROM storage density at least through 1996. One-megabit chips are selling now, two-megabit versions should be available later this year, and four-megabit chips should follow in 1991. When 16-megabit chips arrive by 1994, vendors could introduce 32MB and 48MB "hard drives" on a card roughly two by three inches.

Texas Instruments (TI) is offering a similar technology that uses less power than Intel's flash EPROMs during data writing. In the typical flash-EPROM computer, all logic and memory operations require five volts of electricity, except for writing to the flash EPROM, which takes 12 volts. TI's new chips eliminate the need for a 12-volt power supply anywhere in the machine, saving space and weight. 256-kilobit chips are already available, with one-megabit versions expected by the end of this year.

Production efficiencies and price competition are likely to drive flash EPROM prices down to the level of dynamic RAM chips by 1994, Robinson asserts. By then, the whirl of disk drives could be little more than a fast-fading memory.